APPALACHIAN GEOLOGY

Synthesizing information through a dinosaur toy:

An integrative assignment that is scalable for a variety of learners

Andrew B. Heckert (ABH)

APPALACHIAN GEOLOGY

Pedagogical/Philosophical Course Goals

- ….describe the history of dinosaur knowledge, from prescientific mythological explanations to the current synthesis
- …articulate an understanding and appreciation of fundamental principles of geological and biological sciences as applied to dinosaur paleontology.
- …acquire a basic understanding of paleontological and evolutionary principles.
- …demonstrate proficiency in acquiring, interpreting, and disseminating dinosaur knowledge.
- …incorporate scientific, especially geological perspective into the educational experience at ASU.

Cut-and-pasted from ABH course syllabus

APPALACHIAN GEOLOGY

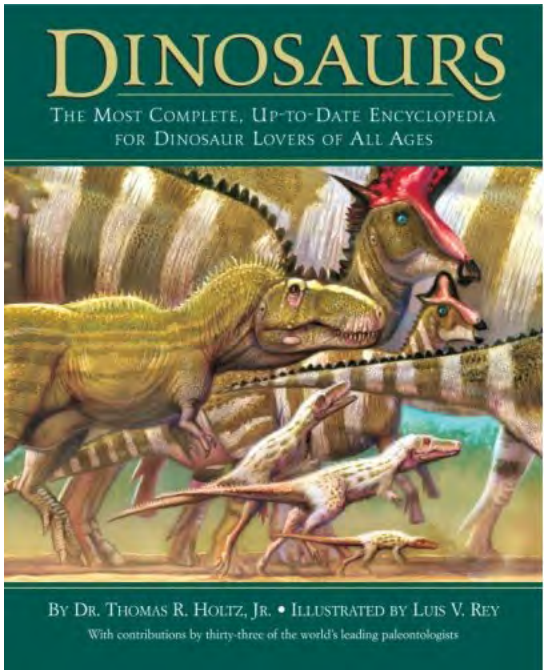
Pragmatic Course Goals

- Get 250-300 credit hours/offering w/out lab.
- Maintain standards w/out reading 80+ papers.
- Encourage students to take GLY courses for science requirement.
- Pick up a few majors and minors.
- Make the administration happy, especially those in charge of general education.
- Force a few more folks to face the "e" word, deep time, and other scientific concepts.

GLY 1842—Nuts-and-bolts

APPALACHIAN GEOLOGY

- Geology course, but non-science theme
- Counts toward general education, GLY minor
- 3 credit hours, no lab
  - either MWF 50 minutes; TR 75 min.
- Fall 2015, TR, n = 57; Fall 2016 MWF n = 78
- Use ASULearn (Moodle) course software
- Textbook is Holtz & Rey (2007)
  - Cheap, but "free" (rental)



GLY 1842—Nuts-and-bolts

APPALACHIAN GEOLOGY

- **Course grade based on**
- 8% Participation (mostly clickers)
- 5% Weekly (more or less) "prequizzes" on ASULearn
- 8% ASULearn exam 1 (date info)*
- 8% ASULearn exam 2 (date info)*
- 8% ASULearn exam 3 (date info)*
- 8% ASULearn exam 4 (date info)*
- 9% In-class exam (date info)*
- 11% In-class exam 2 (date info)*
- 20% Dinosaur projects (See below; due dates TBA)
- 15% Final exam (date info)*
- Total: 100%

- ***Exam dates are *immutable*—see http://www.registrar.appstate.edu/calendar/fallexampolicy.html**

Assignment Instructions (handout)

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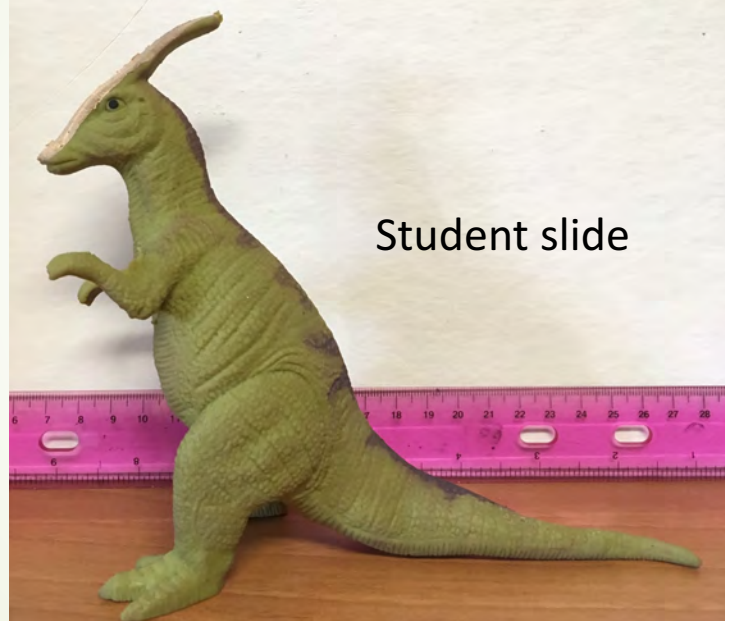
Instructions: Choose (obtain) a non-avian dinosaur toy of your choosing, albeit with the following caveats:
(1) It is of a recognizable dinosaur*;
(2) It is a children's toy or a scale model of an entire dinosaur (not just a skull); and
(3) It has been mass-produced (your review will benefit other purchasers)



*I *might* accept a non-dinosaurian toy (e.g., a pterosaur), but any non-dinosaur has to be cleared with me first.

Assignment Instructions (handout)

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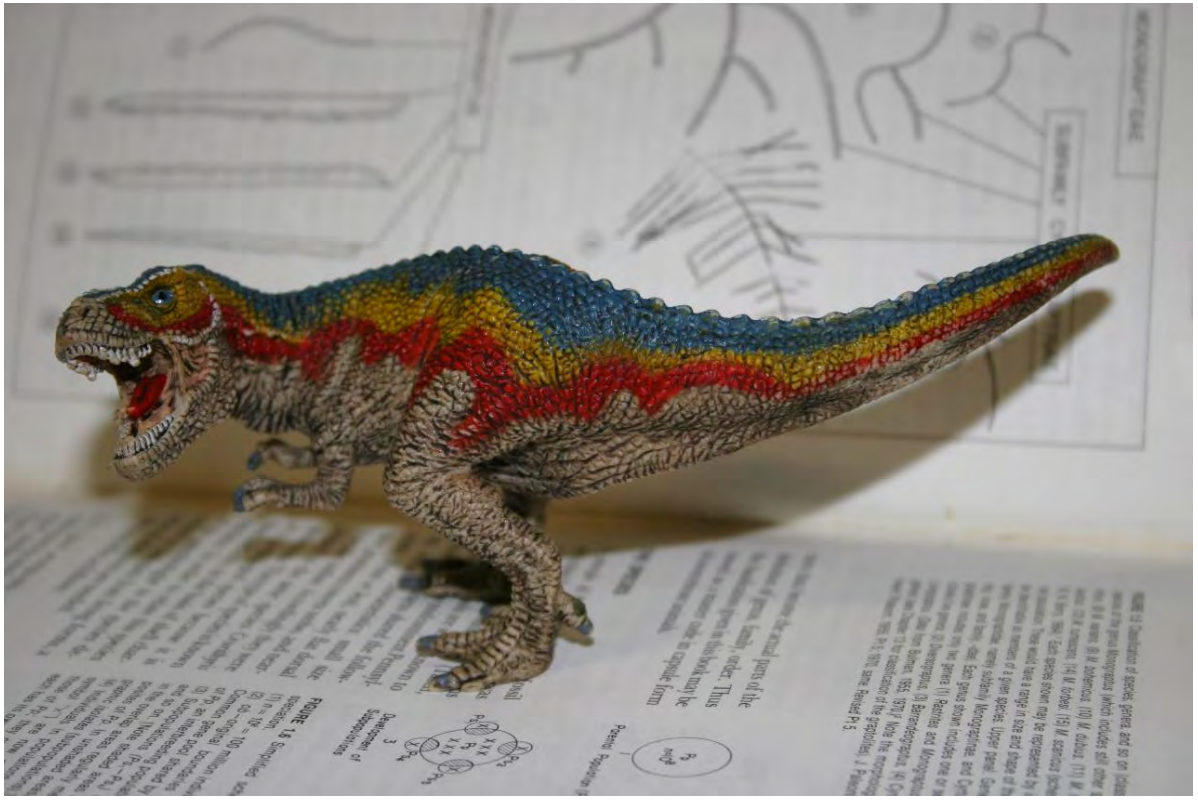
Document and review the toy. This includes labeled pictures of the toy in at least three views, an indication of its size and scale, its classification (Linnaean and cladistic), and an understanding of the "Who, what, when, where, why/how" of the dinosaur. Provide some indication of the strengths and weaknesses of the toy.



Student slide

Assignment web page

APPALACHIAN GEOLOGY

Dinosaur Toy Review

Edit

This is where information regarding the "dinosaur toy review" assignment will be posted.

- Final Dinosaur Toy Upload Site — Edit

  This is the place to upload your final dinosaur toy review project. Do not be late. Late submissions will be penalized enough that you were better off turning it in on time but incomplete.

- Dinosaur Toy Selection Upload — Edit

  Please upload your first dinosaur toy ppt here. This should include a title slide with your name and the name of the dinosaur as well as a slide(s) with a few pictures. Please see "ABHDinoToySelectionMockup" for details.

  Please save your file as LastnameDinosaurToy, where "Last Name" is your last name, and dinosaur is the subject of your project. Thus, if ABH did *Triceratops*, it would be HeckertTriceratopsToy

- ABH Mockup & Instructions for Dinosaur Toy Selection — Edit
- Dinosaur Toy Review Assignment Sheet — Edit
- Timescale for your dinosaurs — Edit
- Calculating the scale of your dinosaur toy — Edit
- Example of scale calculations w/Coelophysis — Edit
- ABH Mock-up Coelophysis — Edit
- Fun clip of an expert reviewing dinosaur toys — Edit

+ Add an activity or resource

GLY 1842—Toy choice mock-up

APPALACHIAN GEOLOGY

- IU Field Camp Philosophy: Practice everything
- Dinosaur toy selection is a brief assignment
  - "Low stakes"
- Text in green is an aside for this presentation
- "ABH" in corner means my slide
- "student slide" means an actual submitted slide (used w/permission).

“Mock-up”/template

- This is ABH’s “template” for the assignment
- This is a minimum—I encourage you to be creative and expand on it and make it yours, I just wanted to provide examples
  - So feel free to pick your background colors, fonts, artwork, etc.
- Slides with “Don’t” on them mean “Don’t do this” as in they are bad examples.

ABH

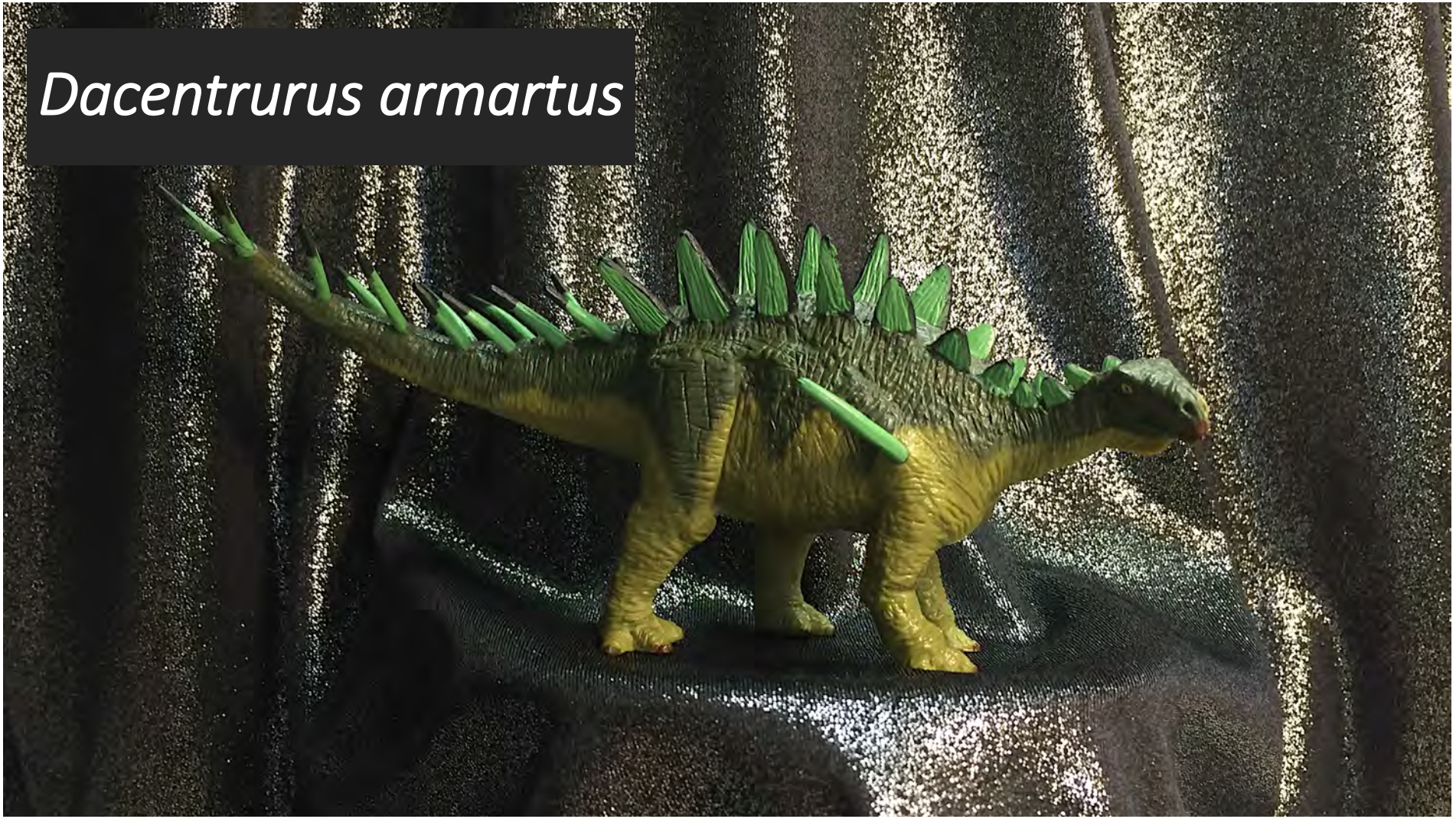
Some Do's and Don'ts

- **DO** *italicize* your genus name (e.g., *Coelophysis)*
  - And species, too! E.g., *C. bauri*
- **DON'T** italicize any other taxonomic name (Theropoda, Dinosauria)
- **DO** document your sources
- **DO** use Google Scholar® (scholar.google.com)
- **DON'T** just rely on the Wikipedia
- **DON'T** include slides like this one and the previous

ABH

Coelophysis: a review of the toy by Geoworld® (2012)

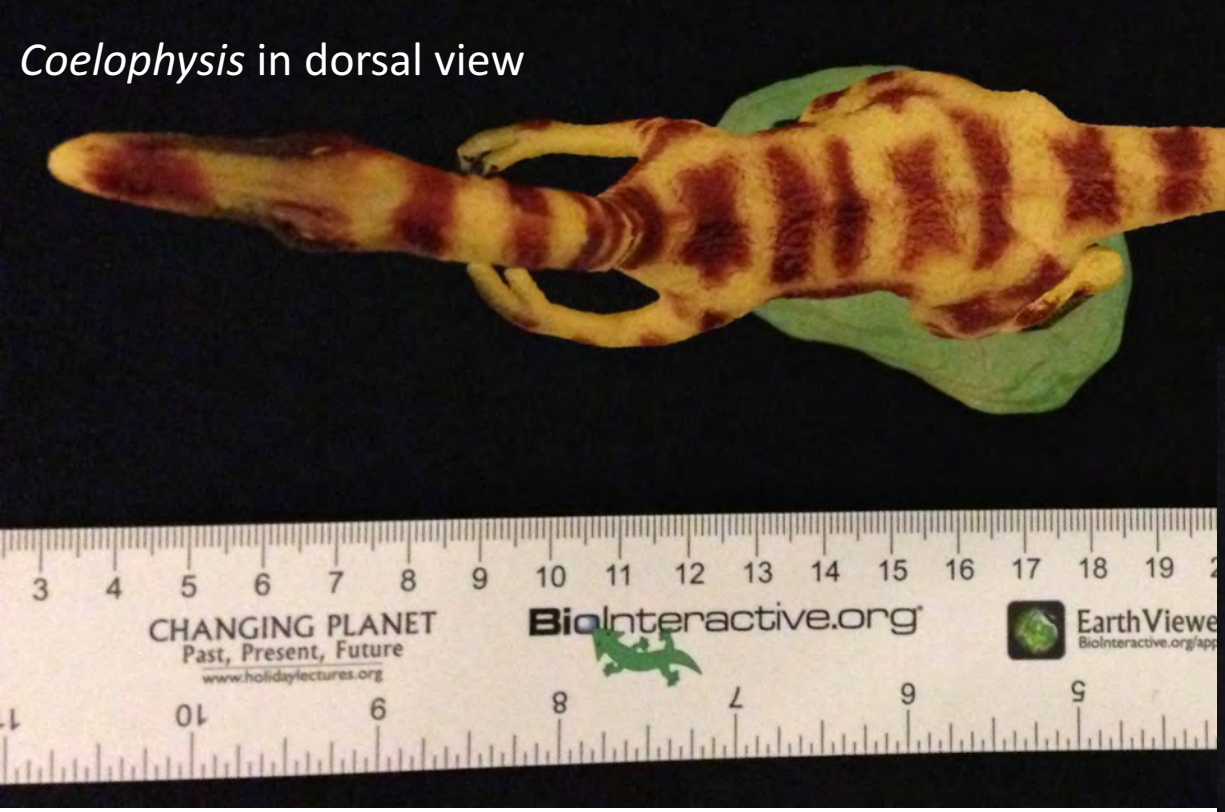
ABH



Student slide

Coelophysis in left lateral view

Coelophysis in dorsal view



Coelophysis in anterior view

ABH

A bad shot (no scale; busy background; not even super-clear focus)

So the toy selection slide

- **Should have a title**
- **Should** *italicize* your genus name (e.g., *Coelophysis)*
  - And species, too! E.g., *C. bauri*
- **Should** have slides with multiple (labeled) views of your toy
- **Should** be named YourlastnameGenusToy
- **Should not** have instructions slides

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Time to grade!

APPALACHIAN GEOLOGY

Submission status

Submission status	Submitted for grading
Grading status	Graded
Due date	Friday, 4 November 2016, 5:00 PM
Cut-off date	Monday, 7 November 2016, 5:00 PM
Time remaining	Assignment was submitted 2 days 6 hours early
Editing status	Student cannot edit this submission
Last modified	Wednesday, 2 November 2016, 10:29 AM
File submissions	BaileyAnkylosaurusToy.pptx
Submission comments	Comments (0)

The grader's most important question

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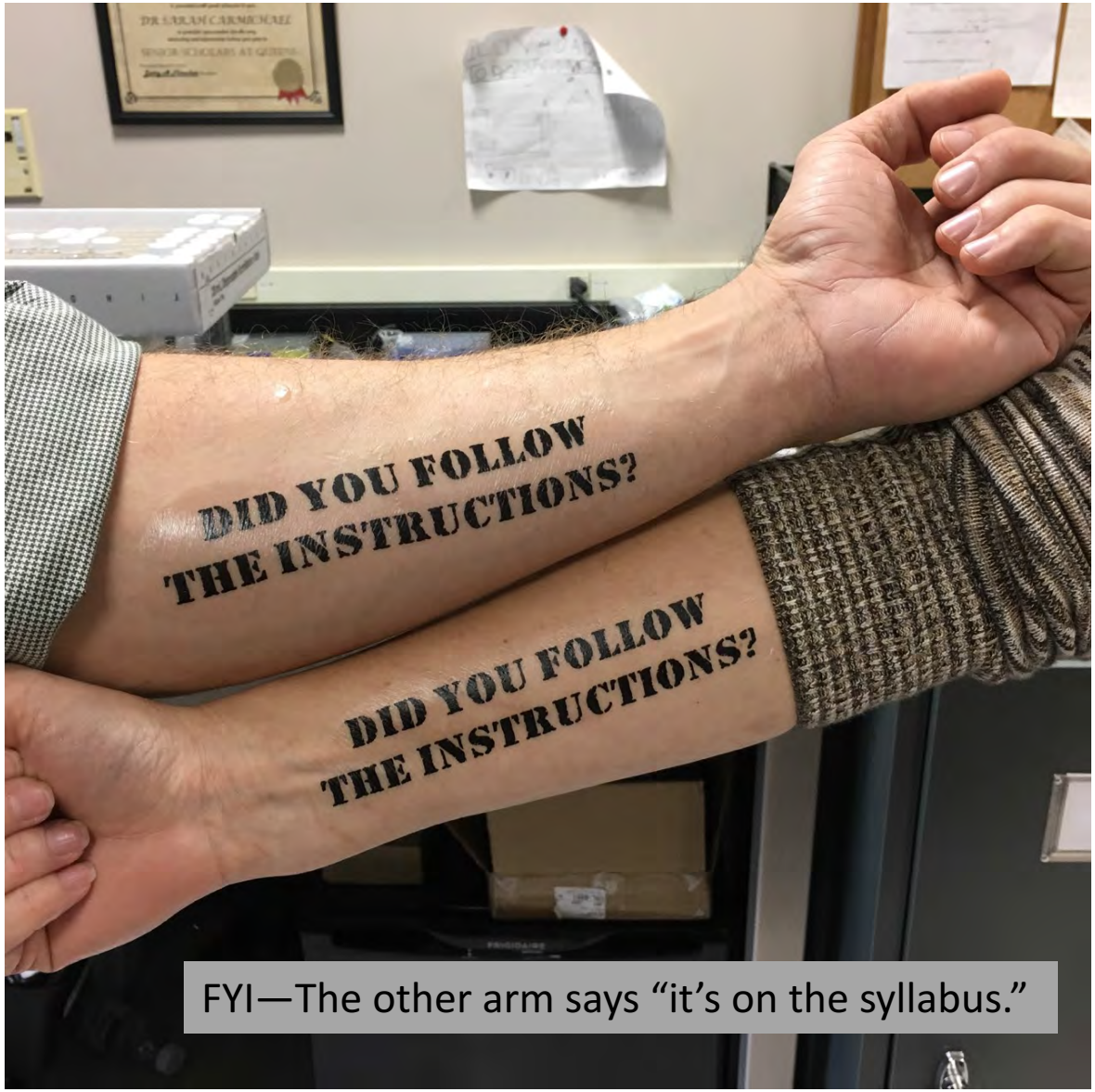


FYI—The other arm says "it's on the syllabus."

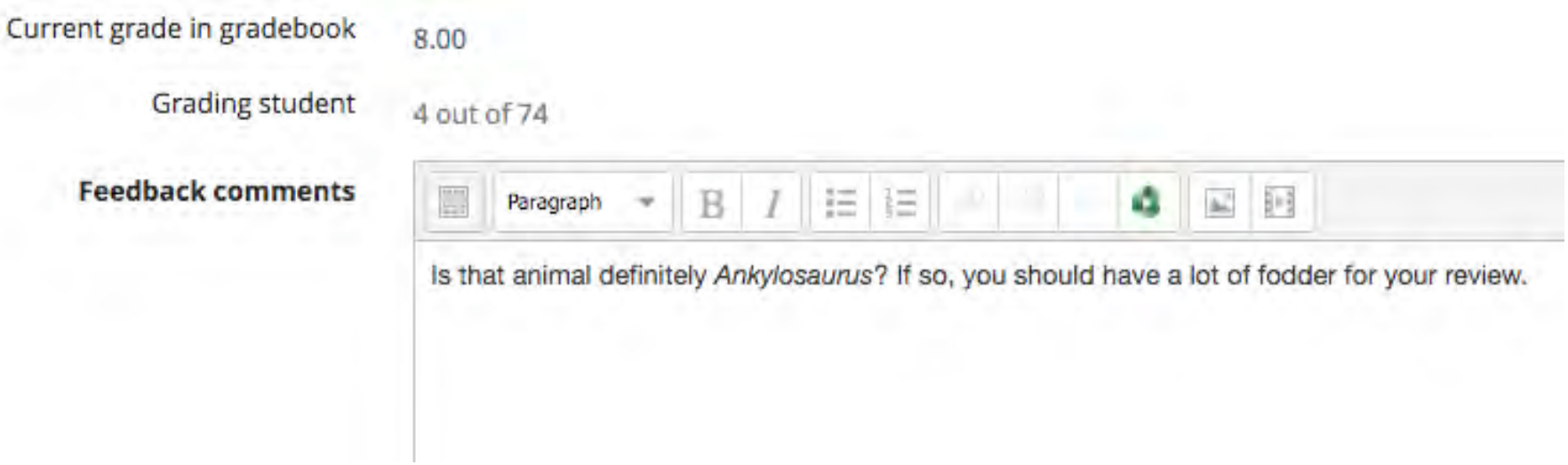
Rubric set up in ASULearn

APPALACHIAN GEOLOGY

Grade: Rubric for the "Dinosaur Toy Assignment" upload of the title slide plus three views of the specimen.

Title Slide	Format (Name, toy name, italics, photo, fall) *0 points*	1/5 *1 points*	2/5 *2 points*	3/5 *3 points*	4/5 *4 points*	5/5 *5 points*	
Specimen photos	3+ views, each labeled, scale present *0 points*	1/6 *1 points*	2/6 *2 points*	3/6 *3 points*	4/6 *4 points*	5/6 *5 points*	6/7 *6 points*	7/7 *7 points*	Some scales missing; "left lateral" view is oblique
File name correct	Nope *0 points*	Close *1 points*	Nailed it *2 points*					
Instructions Slides deleted	Didn't delete anything/reused Heckert's template *0 points*	Extraneous slides present *1 points*	Only slides needed *2 points*					
Apparent Effort/Aesthetics	None *0 points*	Minimal *1 points*	Meh *2 points*	Decent *3 points*	Extra effort apparent *4 points*			

Comments, etc.



Thus, if I disapprove of a “dinosaur” choice I can make comments here.

ABH's "mock-up"

APPALACHIAN GEOLOGY

- **Pros:**
  - Provides fairly unambiguous examples
  - Educates students about *Coelophysis*
  - Forces them to learn presentation software
- **Cons**
  - A little too "plug & chug"/"plug & play"
  - Does not evaluate writing *per se*
  - References—what to do?
  - Rubric hurts grade flexibility
- **Notes**
  - I repeat the initial slides (instructions, title, views) in the mock-up, but we're skipping to the good stuff

Table of Contents

APPALACHIAN GEOLOGY

- Title slide w/toy & manufacturer, name, date
- Slides with toy in multiple views
- Specifications (scale & measurements)
- Timescale slide
- Skeleton slide
- Reconstruction slide
- Paleogeographic map
- Cladogram slides (general; detailed)
- Linnaean classification slide
- Pros & Cons slide
- Summary slide
- References slide

ABH

Grading first few slides

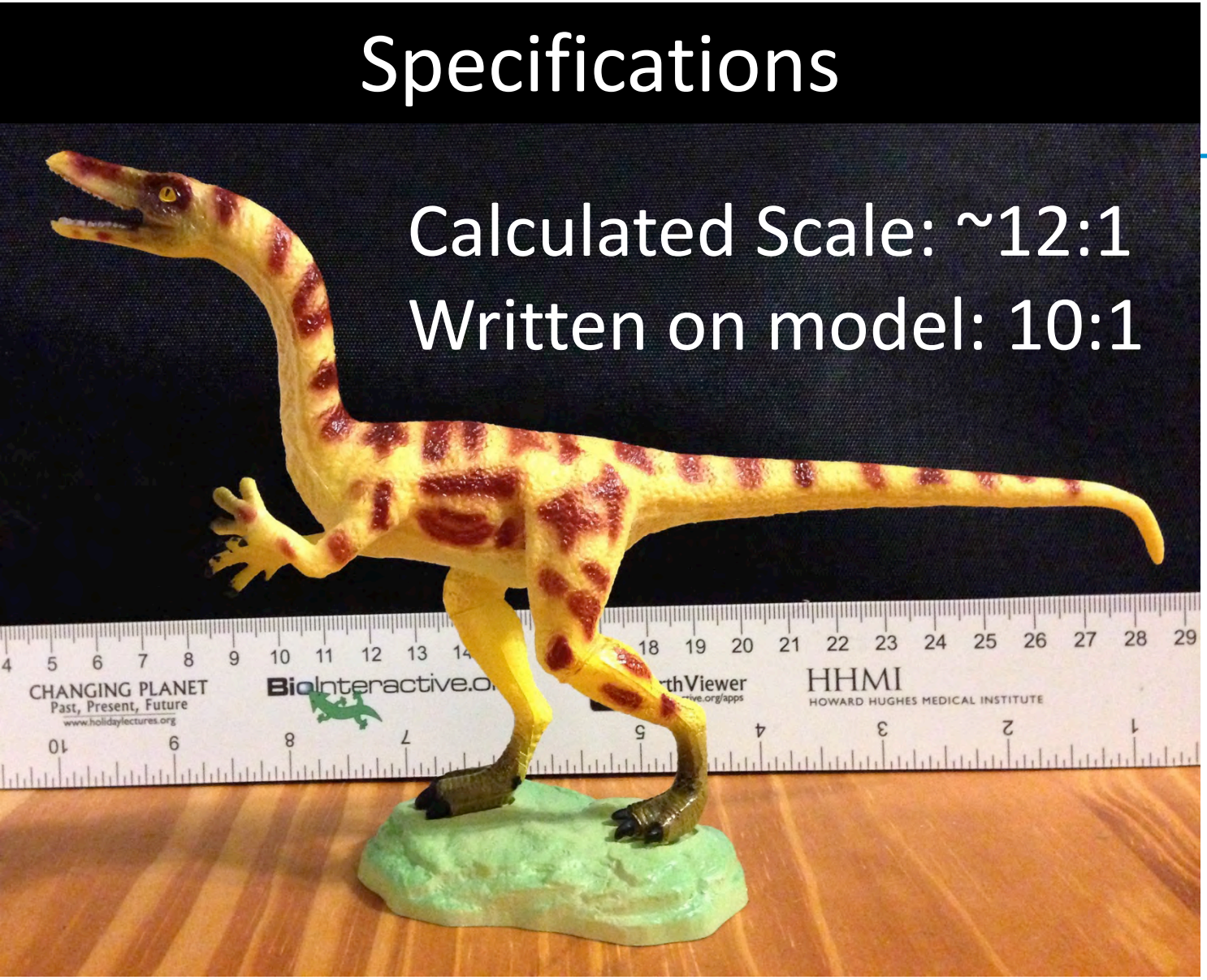
APPALACHIAN GEOLOGY

Grade: Rubric for the dinosaur toy final upload

Title Slide	Format (Name, toy name, italics, photo, fall) *0 points*	1/5 *1 points*	2/5 *2 points*	3/5 *3 points*	4/ *4 points*	5/5 *5 points*
File name correct	Nope *0 points*		Close *1 points*		Nailed it *2 points*	
Table of Contents	Nope *0 points*	Present, confused or confusing *1 points*		Present, useful *2 points*	Present, well done *3 points*	

Mostly “free” points to help build a reserve if they lose “ticky-tack” points later

Specifications



The *Coelophysis* model is approximately 12:1 scale (2.7 m real life/0.22 m model) = 12.3
Length measurement from Holtz & Rey (2008); according to this model, a full-sized *Coelophysis* would thus be 2.7 m long, 1.5 m tall, and 0.4 m wide across the hips.

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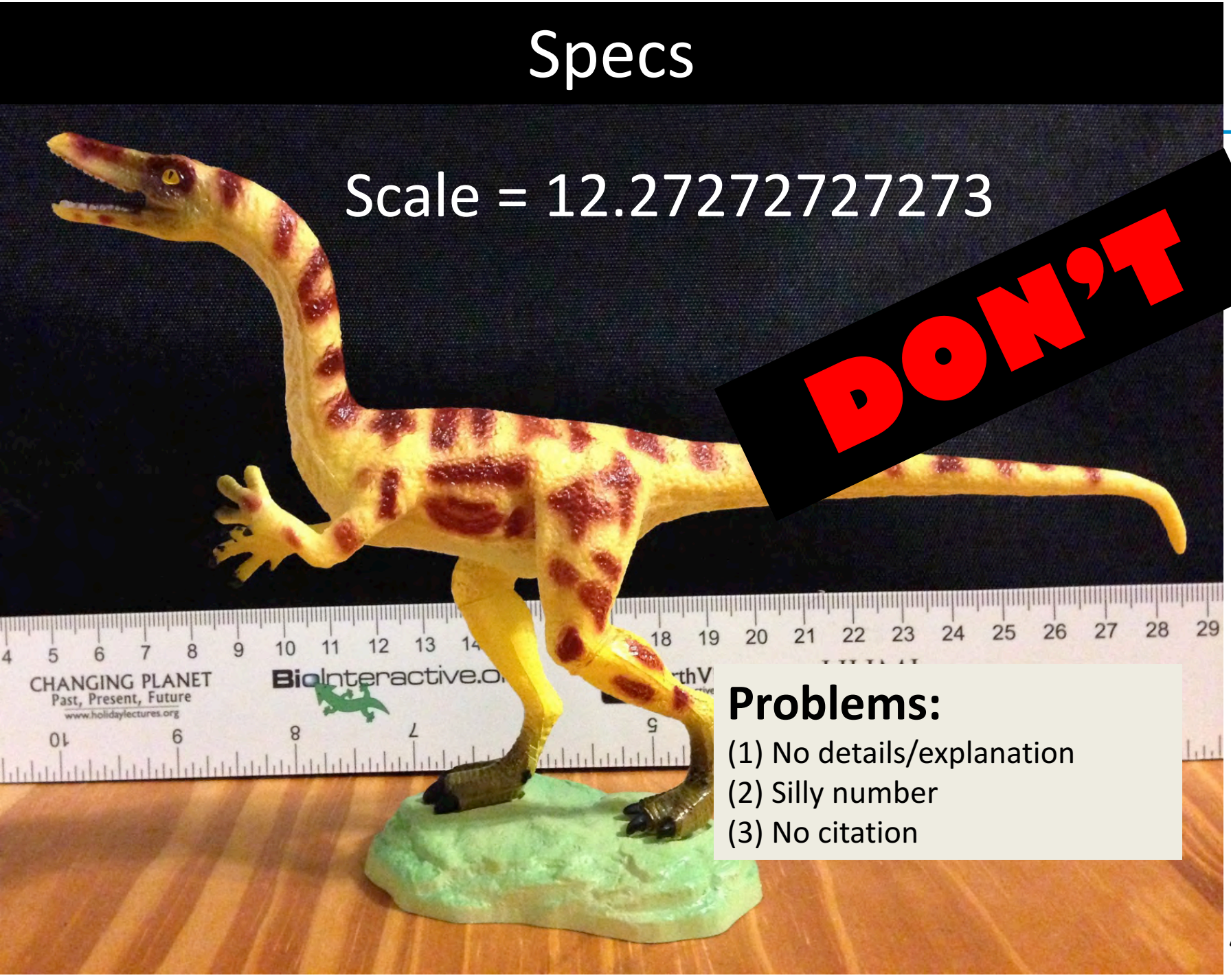
Specs


Scale = 12.27272727273
DON'T
CHANGING PLANET
Past, Present, Future
www.holidaylectures.org
BioInteractive.o
Problems:
(1) No details/explanation
(2) Silly number
(3) No citation

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Naming *Coelophysis*

Coelophysis is one of the older names given to a dinosaur, it was named by E.D. Cope in 1887.

Cope, E.D., 1887, The dinosaurian genus *Coelurus*. American Naturalist, v. 21, p. 367-369

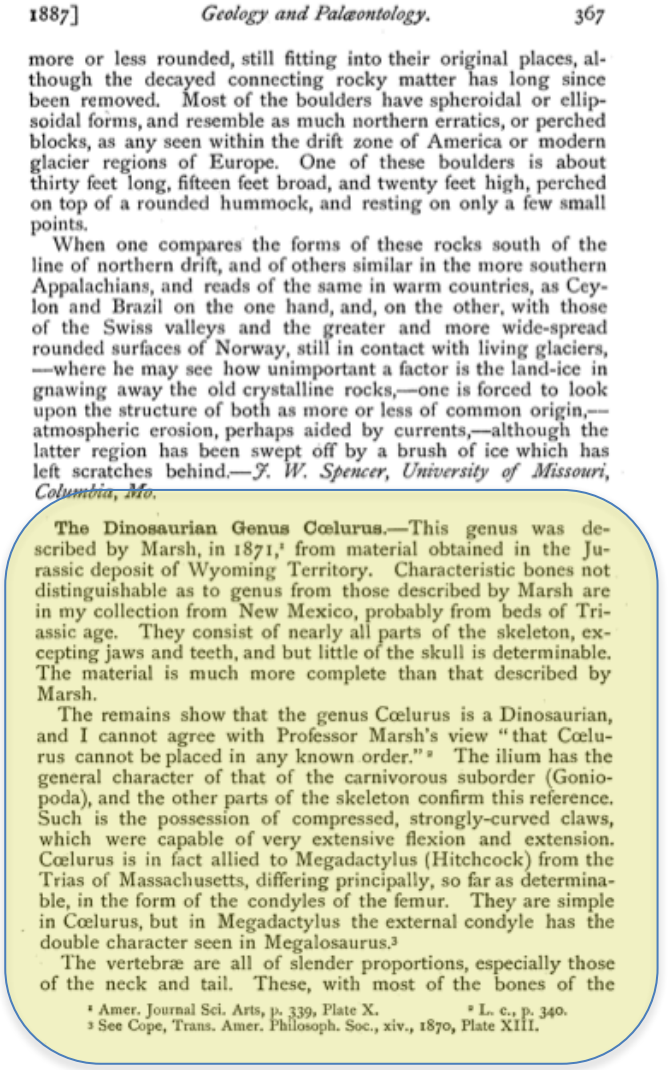
Cope, E.D., 1889, On a new genus of Triassic Dinosauria. American Naturalist, v. 23, p. 626.

***Just so you know, *Coelophysis* has a complex history. Cope referred his new species to Marsh's genus *Coelurus* in 1887, but in 1889 published (correctly) that they belonged in a different genus, so the species was named in 1887 even if the genus wasn't assigned until later.

And it gets more complicated from there.

Most popular dinosaurs were named in articles now linked from the Wikipedia or otherwise easily available

ABH



1887] *Geology and Palæontology.* 367

more or less rounded, still fitting into their original places, although the decayed connecting rocky matter has long since been removed. Most of the boulders have spheroidal or ellipsoidal forms, and resemble as much northern erratics, or perched blocks, as any seen within the drift zone of America or modern glacier regions of Europe. One of these boulders is about thirty feet long, fifteen feet broad, and twenty feet high, perched on top of a rounded hummock, and resting on only a few small points.

When one compares the forms of these rocks south of the line of northern drift, and of others similar in the more southern Appalachians, and reads of the same in warm countries, as Ceylon and Brazil on the one hand, and, on the other, with those of the Swiss valleys and the greater and more wide-spread rounded surfaces of Norway, still in contact with living glaciers, —where he may see how unimportant a factor is the land-ice in gnawing away the old crystalline rocks,—one is forced to look upon the structure of both as more or less of common origin,—atmospheric erosion, perhaps aided by currents,—although the latter region has been swept off by a brush of ice which has left scratches behind.—*J. W. Spencer, University of Missouri, Columbia, Mo.*

The Dinosaurian Genus Cœlurus.—This genus was described by Marsh, in 1871,[1] from material obtained in the Jurassic deposit of Wyoming Territory. Characteristic bones not distinguishable as to genus from those described by Marsh are in my collection from New Mexico, probably from beds of Triassic age. They consist of nearly all parts of the skeleton, excepting jaws and teeth, and but little of the skull is determinable. The material is much more complete than that described by Marsh.

The remains show that the genus Cœlurus is a Dinosaurian, and I cannot agree with Professor Marsh's view "that Cœlurus cannot be placed in any known order."[2] The ilium has the general character of that of the carnivorous suborder (Goniopoda), and the other parts of the skeleton confirm this reference. Such is the possession of compressed, strongly-curved claws, which were capable of very extensive flexion and extension. Cœlurus is in fact allied to Megadactylus (Hitchcock) from the Trias of Massachusetts, differing principally, so far as determinable, in the form of the condyles of the femur. They are simple in Cœlurus, but in Megadactylus the external condyle has the double character seen in Megalosaurus.[3]

The vertebræ are all of slender proportions, especially those of the neck and tail. These, with most of the bones of the

[1] Amer. Journal Sci. Arts, p. 339, Plate X. [2] L. c., p. 340.
[3] See Cope, Trans. Amer. Philosoph. Soc., xiv., 1870, Plate XIII.

Title page from the 1887 article

APPALACHIAN GEOLOGY

NAMING *DIPLODOCUS*

- Marsh (1878) Marsh OC. Principal characters of American Jurassic dinosaurs, Part I. American Journal of Science (series 3) 1878;16:411–416.
- The first skeleton was found in 1877 and was named *Diplodocus longus* ('long double-beam'), by paleontologist O. Charles Marsh in 1878.
- It was named along with other members of the Sauropod suborder.
- The most well know *Diplodocus* species are *D. carnegii, D. hallorum,* and *D. longus.*

Diplodocus longus, gen. et sp. nov.

This genus includes some Dinosaurs of very large size, and herbivorous in habit. It may be distinguished from the genera already known by the caudal vertebræ, which are elongated, deeply excavated below, and have double chevrons, with both anterior and posterior rami. (Plate VIII, figures 3 and 4). To the last character, the generic name refers. The tibia, also, is a very characteristic bone, as it is deeply grooved above to receive the fibula. The feet in this genus are very similar to those of *Morosaurus*, shown in Plate VII.

The present species is based upon one posterior limb, and the tail, of a single individual. The limb, as extended before removal, measured from the head of the femur to the end of the toes over thirteen feet (4·1^{M}). The femur was 1645^{mm} in length, and the tibia 1090^{mm}. Four of the median caudal vertebræ measured together thirty-four inches (760^{mm}). The first of these, or the fourteenth in the series, was eight and one-half inches (217^{mm}) long, and five and one-half inches (140^{mm}) across the anterior end.

Of this suborder, *Sauropoda*, four genera are well represented in the Museum of Yale College, and others, apparently closely allied, are indicated by remains from this country and Europe described by various authors. The genera *Atlantosaurus*, (*Titanosaurus*),* *Apatosaurus* and *Morosaurus*, have already been described by the writer, and with the new genus *Diplodocus*, defined below, are the most characteristic American representatives of this group. Of these, *Morosaurus* is

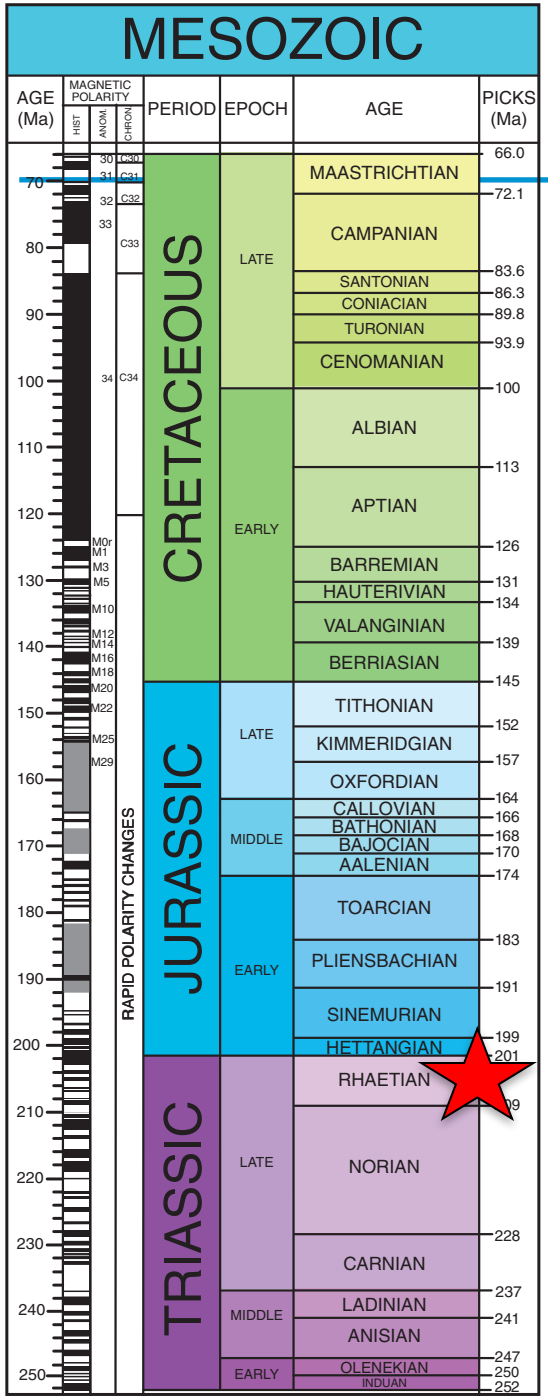
*excerpts pages 412 & 414 from Marsh's "Principal characters of American Jurassic dinosaurs."

Student Slide

Grading the next few

APPALACHIAN GEOLOGY

Specimen Photos	3+ views, labeled, scale present, clean backgrounds *0 points*	1/8 *1 points*	2/8 *2 points*	3/8 *3 points*	4/8 *4 points*	5/8 *5 points*	6/8 *6 points*	7/8 *7 points*	8/8 *8 points*
Scale Slide	Shot w/a good scale, scale stated, math looks reasonable/ no silly numbers, cites a source for size; reasonable calculations of "real size"' *0 points*	1/5 *1 points*	2/5 *2 points*	3/5 *3 points*	4/5 *4 points*	5/5 *5 points*			
Naming slide	Correct attribution of name; screen shot of title slide; reasonable explanation *0 points*	1/3 *1 points*	2/3 *2 points*	3/3 *3 points*					



When did *Coelophysis* live?

Relative age: Late Triassic (Rhaetian)
Numerical age: Approximately 202-206 Ma

I try to indicate that I want them to reuse this slide, as they won't find a better one, but some feel obligated to replace it with a mediocre timescale

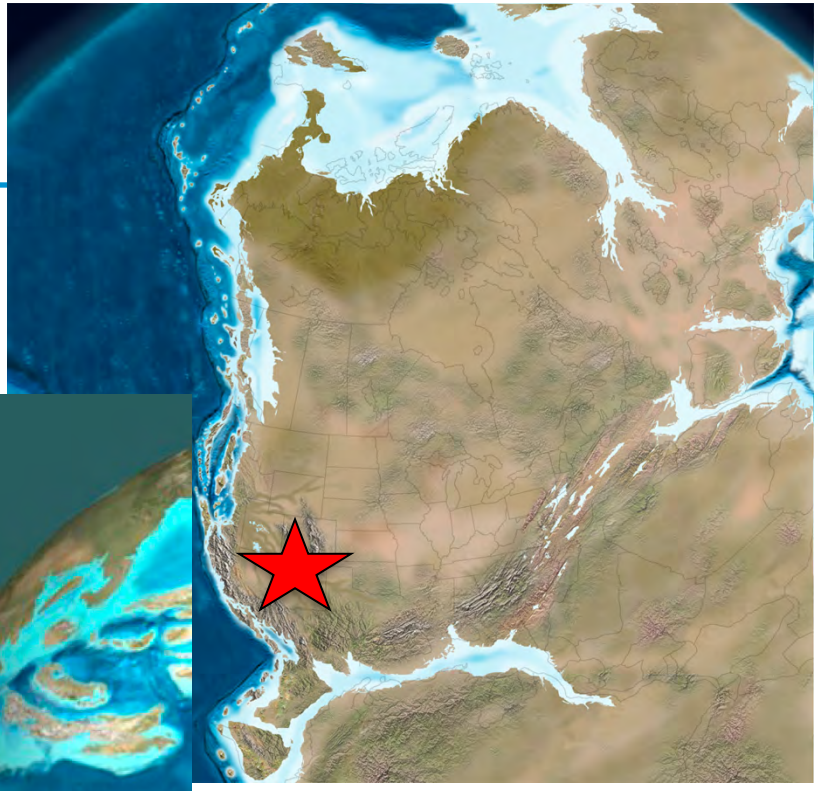
Coelophysis is known from the latest Triassic
This is generally considered the Rhaetian and is approximately 205 million years ago.

ABH

Timescale from Geological Society of America (GSA, 2012)

Where did *Coelophysis* live?

Coelophysis is from New Mexico, which was near the west coast of equatorial Pangea during the Triassic, when all the continents were welded together.



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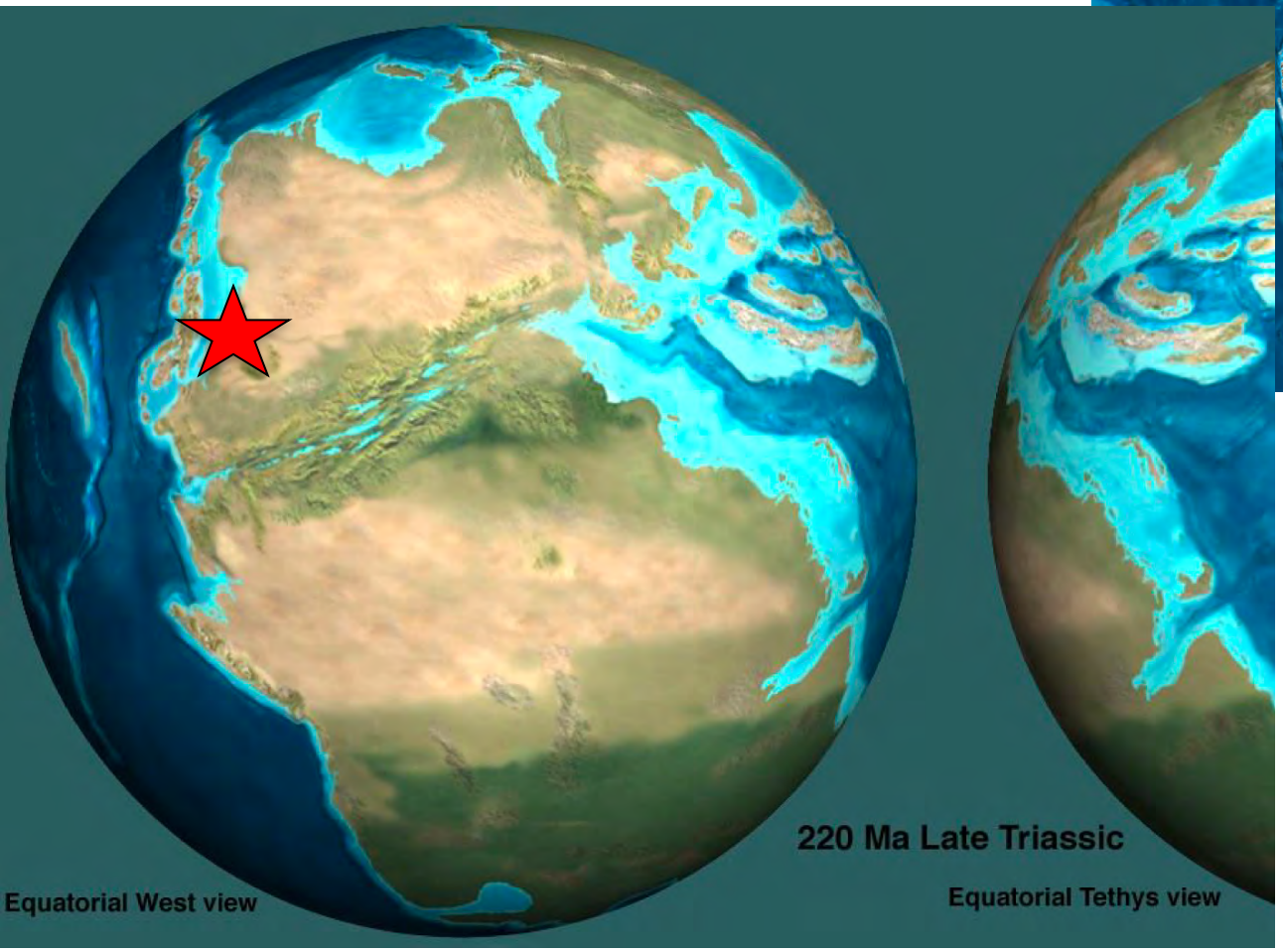

http://www.sepmstrata.org/CMS_Images/Forams/Paleoeco/late%20triassic2.JPG

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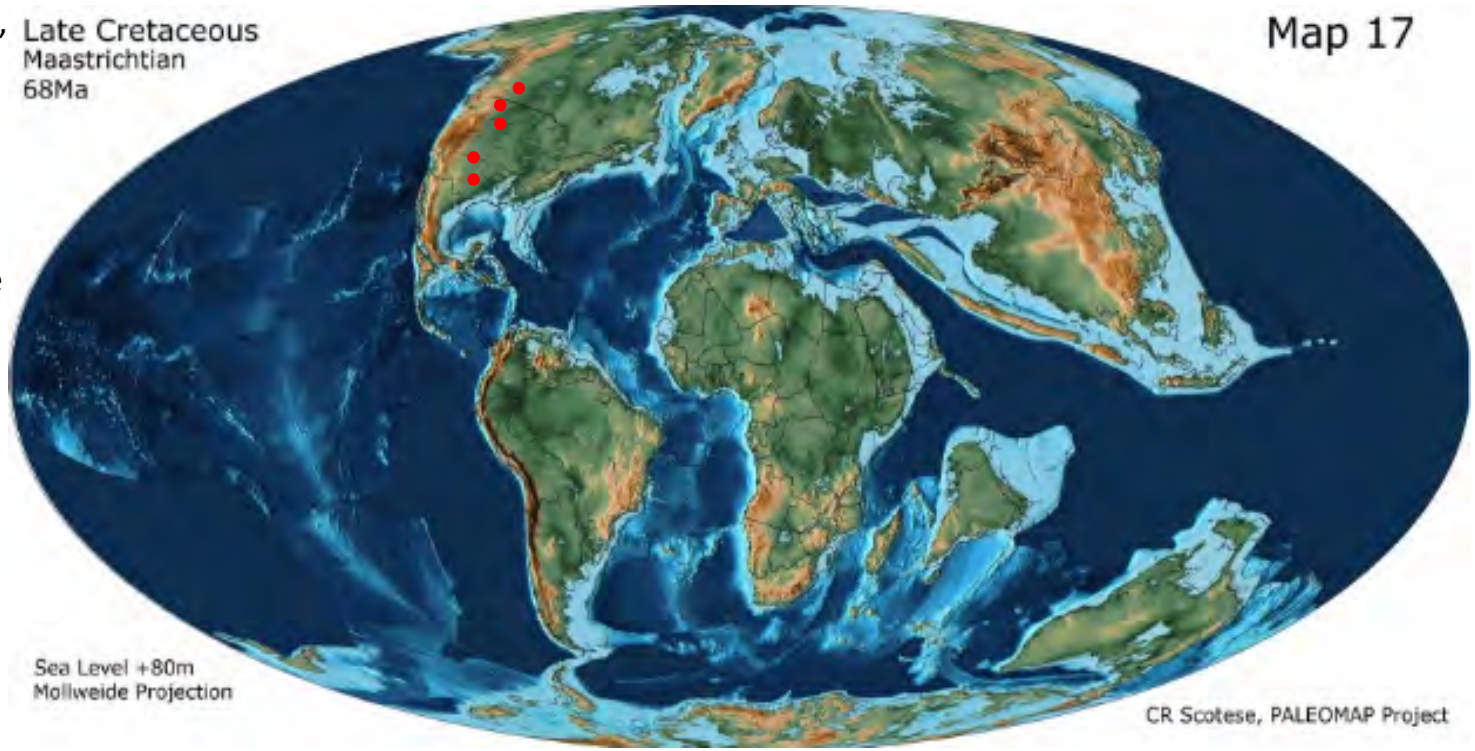
Where did Tyrannosaurus Rex live?

The paleogeographic distribution of *T. rex* is the Interior Western United States and parts of Canada. Locations where *T. rex* fossils have been found are: Colorado, New Mexico, Texas, Montana, Wyoming, South Dakota and Alberta.

T. Rex fossils are most commonly found in the Western United States. The most famous *T. rex* fossil was found in South Dakota (Sue).

The red dots indicate locations where *Tyrannosaurus rex* fossils have been discovered.

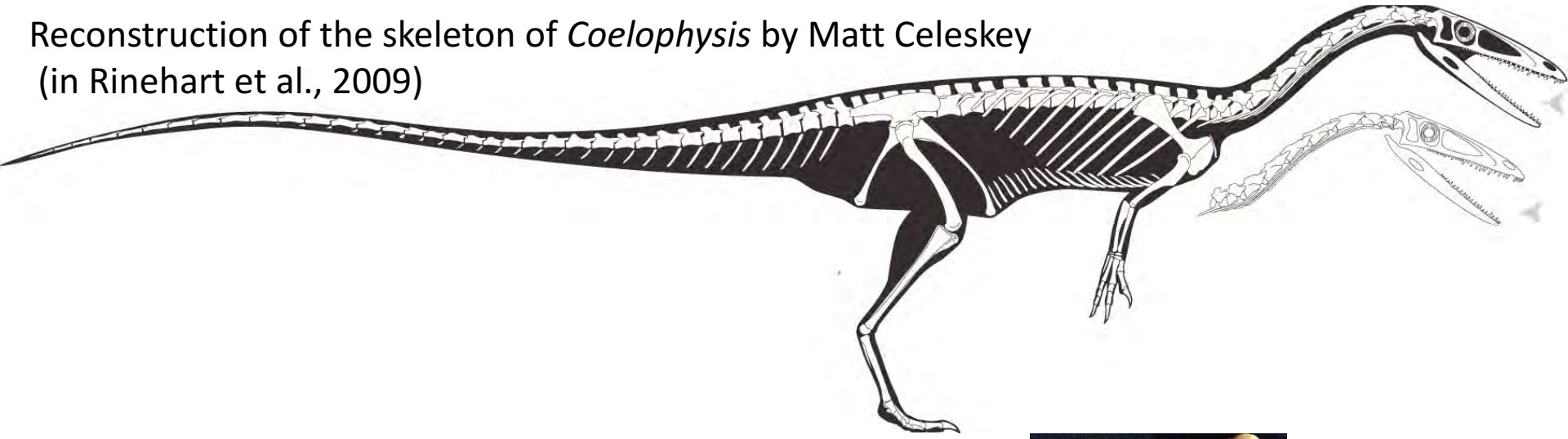


Locations provided by Sampson (2005) and Holtz & Rey (2007)
Maps Scotese (2014)

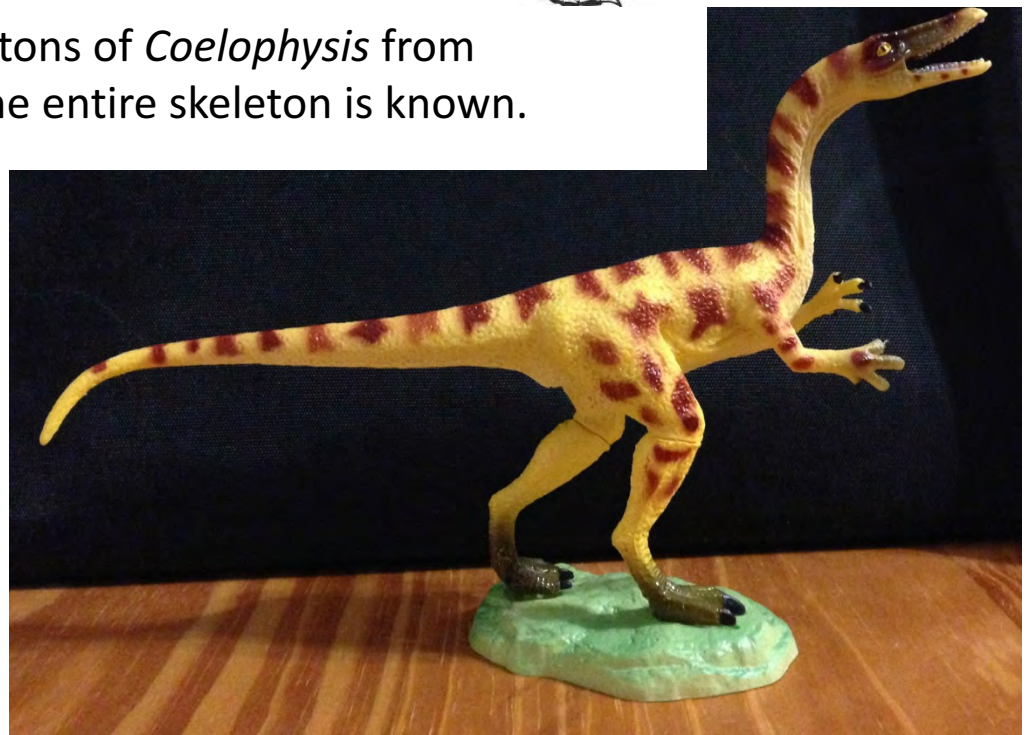
Student Slide

What is known of *Coelophysis*?

Reconstruction of the skeleton of *Coelophysis* by Matt Celeskey (in Rinehart et al., 2009)



Because of the many skeletons of *Coelophysis* from Ghost Ranch, essentially the entire skeleton is known.



ABH

What is known of *Dakotaraptor*?

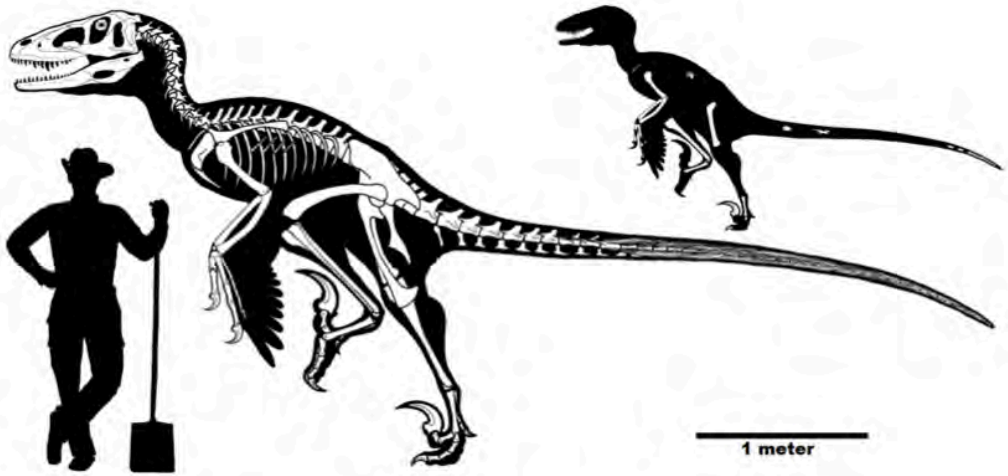


Figure 15. Skeletal reconstruction of *Dakotaraptor* holotype (PBMNH.P.10.113.T) based on available material for *Utahraptor*, *Dromaeosaurus*, *Deinonychus*, and *Achillobator*, demonstrating overall proportions and the large size of the creature. Preserved elements shown in insert.

Reconstruction of the skeleton
(from DePalma et al., 2015)

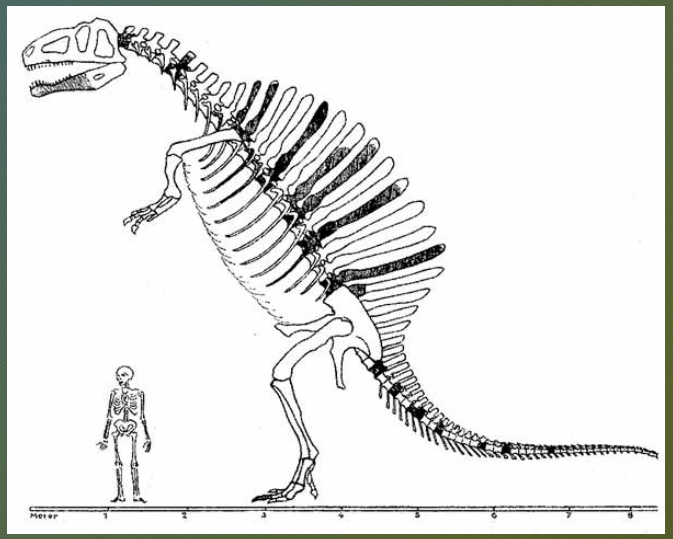
Imagine a *Dakotaraptor* toy here

ABH

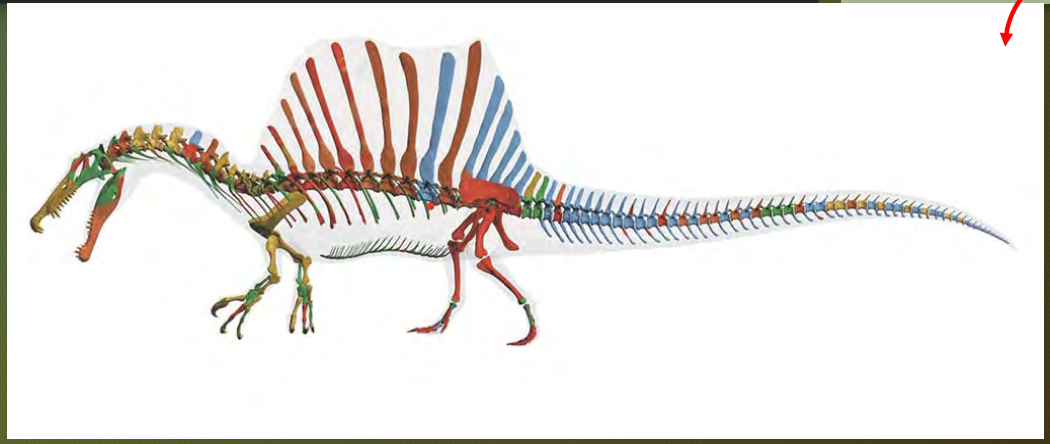
Skeleton of *Spinosaurus*

If you'd like, view video on next slide at minute 40!

- Stromer used *Allosaurus* and *Tyrannosaurus* as models to the missing parts. Many older drawings and models ended up looking like *Tyrannosaurus* with a sail (Holtz 94).



Reconstruction by Stromer, 1936



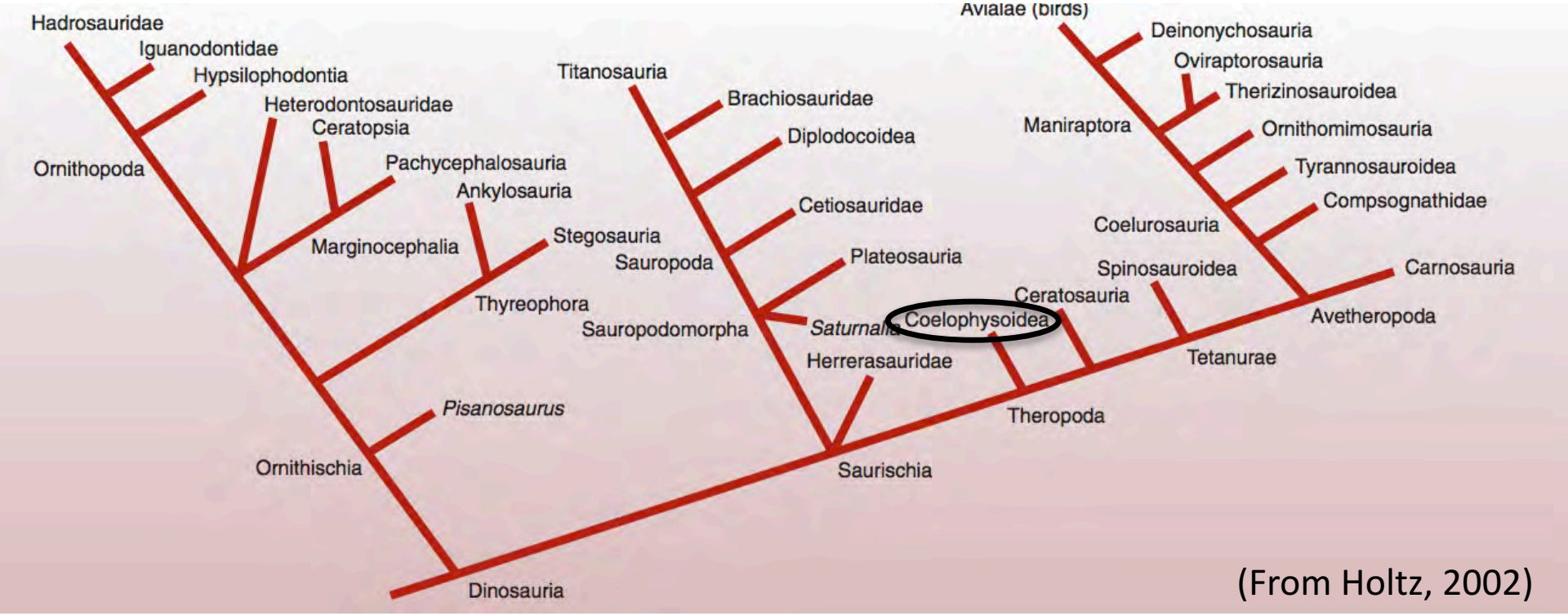
Looking at this reconstruction, you need to know:

- Red/rust-orange = neotype (specimen chosen as 'new holotype' when an original is destroyed) and Stromer's fossils
- Yellow = referred isolated remains (may not be proportional in scaling - basically place "fillers")
- Green = based on other spinosaurids (not from *Spinosaurus*)
- Blue = reconstructed (based on what we know - not actual fossils)

Student Slide

Time scale slide	Star on time scale is correct; relative age; numerical age *0 points*	1/3 *1 points*	2/3 *2 points*	3/3 *3 points*	Note "Triassic" typo
Paleogeographic Map slide	Star(s) on map; map is right age (agrees w/previous slide); map is cited *0 points*	1/3 *1 points*	2/3 *2 points*	3/3 *3 points*	
Skeletal Reconstruction slide	Skeletal reconstruction; reasonable effort to demonstrate what is known; cites reconstruction *0 points*	1/3 *1 points*	2/3 *2 points*	3/3 *3 points*	

Coelophysis in the dinosaur family tree



(From Holtz, 2002)

Coelophysis is a coelophysoid theropod (circled)
This is a relatively primitive group of theropods, which are saurischian dinosaurs.

This figure is from their textbook

ABH

Coelophysis in the theropod family tree

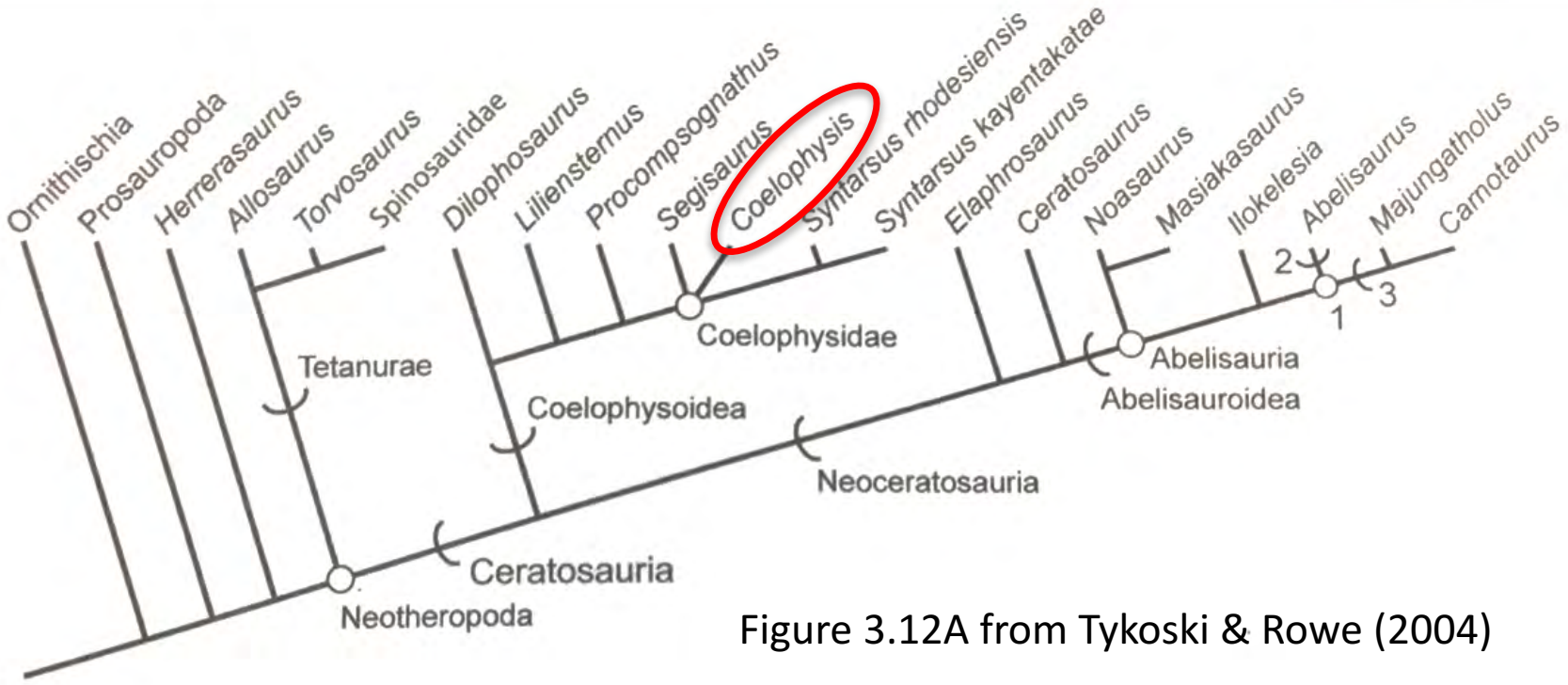


Figure 3.12A from Tykoski & Rowe (2004)

Coelophysis is one of the more derived coelophysoid theropods (circled)
This is a relatively primitive group of theropods,.

In the future I may ask them to tell me who their dinosaur is most closely related to, sister taxon, more "primitive," more derived, etc.

ABH

(From Tykoski & Rowe, 2004)

Coelophysis cladogram

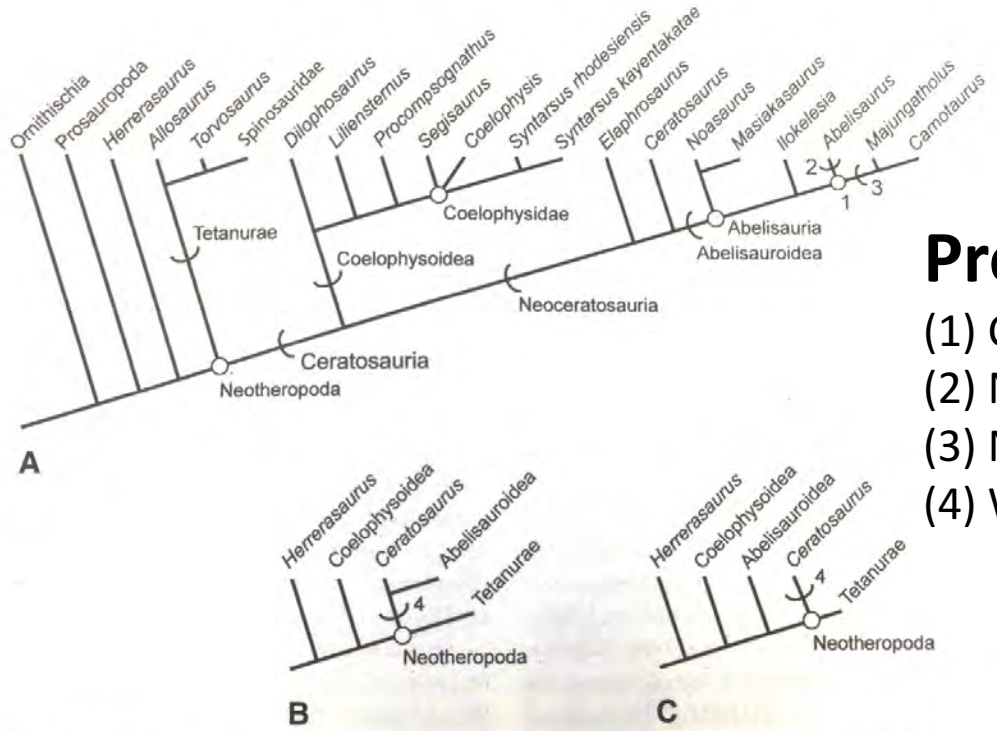


FIGURE 3.12. Phylogenetic hypotheses of ceratosaurian relationships: A, Adams consensus of five equally most parsimonious trees generated by our analysis; tree length = 386, CI = 0.588, RI = 0.739. Stem-defined clades indicated by arcs. Node-defined clades indicated by open circles at nodes. B, alternative phylogenetic hypothesis supported by Sampson et al. (2001). C, alternative hypothesis of ceratosaur relationships from Rauhut (1998) and Carrano and Sampson (1999). 1 = Abelisauridae; 2 = Abelisaurinae; 3 = Carnotaurinae; 4 = Ceratosauria.

Problems:

(1) Crummy picture
(2) No citation
(3) No explanation
(4) WTH is *Coelophysis* on this?

ABH

Linnaean Taxonomy of *Coelophysis*

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- Kingdom: Animalia
  - –Phylum: Chordata
    - Class: Reptilia
      - –Order: Theropoda
        - »Family: Coelophysidae
          - Genus: *Coelophysis*
            - Species: *Coelophysis bauri* (Cope)

Taxonomy follows Holtz (2002)

ABH

Life reconstruction of *Coelophysis*

Reconstruction of a *Coelophysis* flock by Matt Celeskey

From Triassic New Mexico (Lucas, 2008).

ABH

Grading cladograms, taxonomy, etc.

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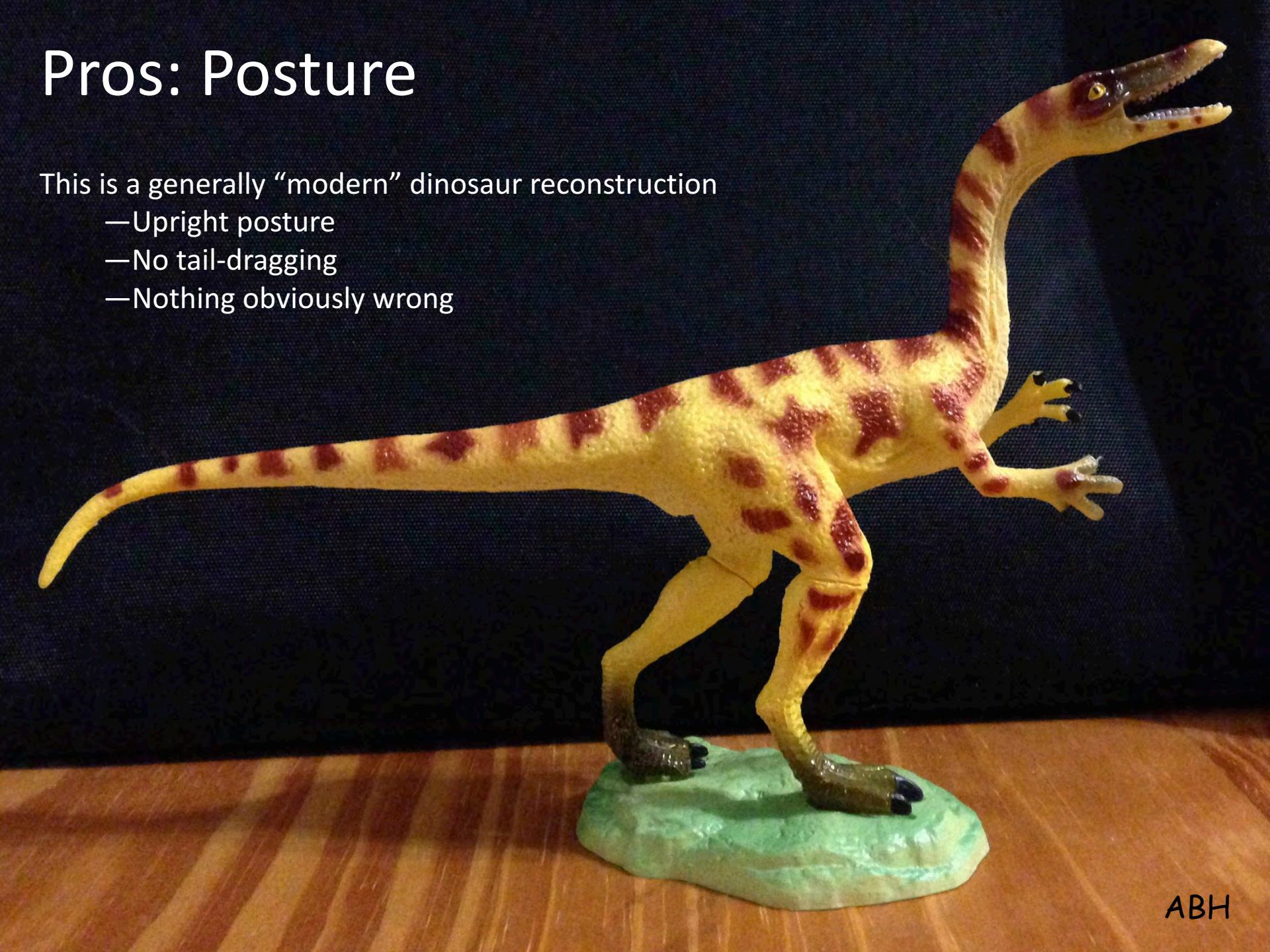
Simple cladogram slide	Present, correct *0 points*	1/2 *1 points*		2/2 *2 points*	
Advanced cladogram slide	Present, correct, cited. *0 points*	1/3 *1 points*	2/3 *2 points*	3/3 *3 points*	
Linnaean taxonomy	Present, correct. *0 points*	1/2 *1 points*		2/2 *2 points*	
Life Reconstruction Slide	Reconstruction present, explained, cited. *0 points*	1/3 *1 points*	2/3 *2 points*	3/3 *3 points*	Has been on display since 1915, but that hall was recently

Pros: Posture

This is a generally “modern” dinosaur reconstruction

- —Upright posture
- —No tail-dragging
- —Nothing obviously wrong

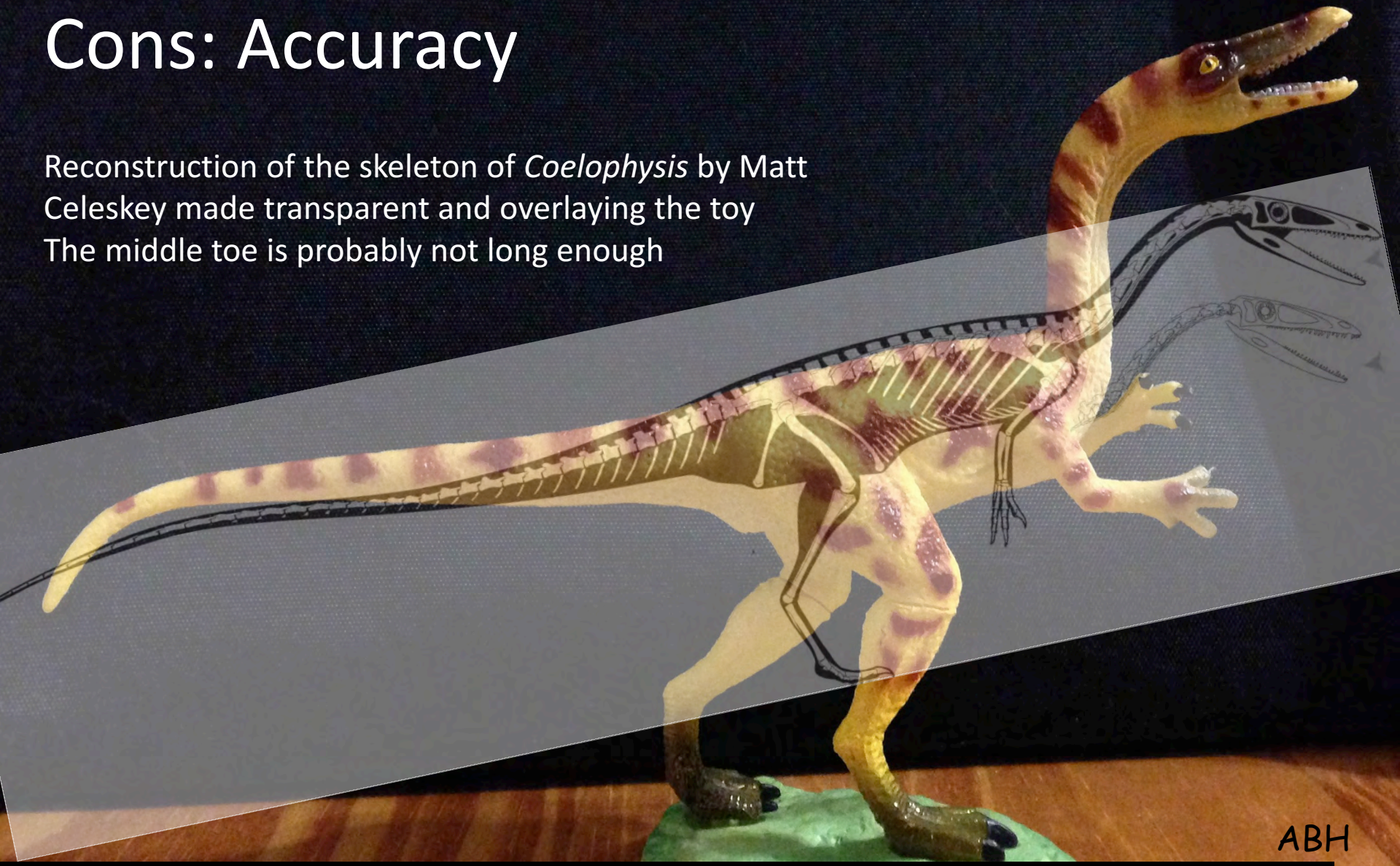


Pros:

Highlights of the toy include the hands (which did have four "fingers" because *Coelophysis* is a primitive theropod) and the base, which actually includes low-tech "tracks"

Cons: Accuracy

Reconstruction of the skeleton of *Coelophysis* by Matt Celeskey made transparent and overlaying the toy
The middle toe is probably not long enough



This shows that the toy is much larger and more robust than the skeleton of *Coelophysis* suggests. Both images are approximately the same body length, but the toy has longer limbs and is generally more robust.

Pros

- Jaw -> Articulated jaw. Moves accurately with respect to the rest of the skull for a dinosaur
- Beak -> Accurately presented beak. While one has never been recovered, it is suspected to have one due to its eating habits.
- Head -> In respect to the rest of its body, the head is small which it is said to have. Scaling done well here.
- Hidden Seams -> Has a creasing affect along the neck, which hides the head/neck connection seam.
- Arms -> Anatomically correct. Only goes about 90 degrees than stops. Also has some great muscle features which shows the eminence strength it had.
- Claws -> Great claws! Length proportional to body. Shows how massive claws were compared to the rest of its body.
- Pelvis -> Has a protruding underside of the pelvis. In skeleton constructs and models all are showing a very distinctive pelvis which wasn't missed on this toy model.

Student slide

Cons: Aesthetics

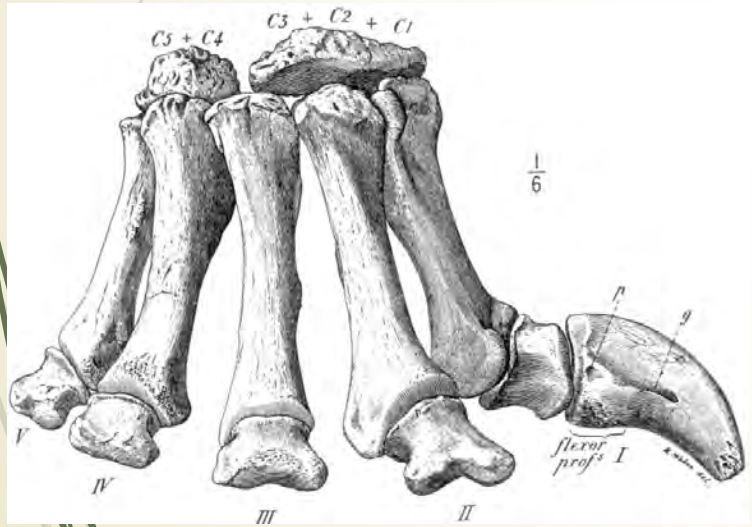
An annoying feature of the toy is the marks just below the knees—it looks like a poor job of joining the legs to the rest of the body.

I doubt the color scheme is very realistic—although the striping might be good, bright yellow and orange is not a terribly likely combination for a predator like *Coelophysis*.

ABH

CON- MANUS AND PES (HANDS AND FEET)

- *Diplodocus* had claws on one digit of the front limb.
  - The toy is missing this claw.
- This claw on the first digit is detached from the rest of the bones in the manus.
  - The toy features fused metatarsals and phalanges.



https://svpow.files.wordpress.com/2012/05/osborn1904-manus-sacrum-caudals-fig1-manus-of-morosaurus-sp.jpeg

From Bonnan, M. F. (2003).

Student slide

Summary

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- *Coelophysis* was a Triassic theropod dinosaur
- The *Coelophysis* toy by Geoworld® looks superficially accurate
- This is one of the few theropod models with 4 fingers (that is correct)
- The scale and proportions are not especially accurate

ABH

Summary (cont)

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- Just to show that you can (and probably should) have more than 1 summary slide

ABH

Grading the evaluations

APPALACHIAN GEOLOGY

Pros & cons	Slide(s) of pros and cons of model present; reasonable; explained; graded as A-F. *0 points*	Incomplete *2 points*	Half-@$$ed *5 points*	Dubious *6 points*	C-level *7 points*	B is for bueno *8 points*	A-ish *9 points*	Outstanding *10 points*	
Overall effort	ABH assessment of the project as a whole *0 points*	Incomplete *2 points*	Half-@$$ed *5 points*	Poor *6 points*	Typical college student work *7 points*	Good work (top 20% of class) *8 points*	Great work (top 10% of class) *9 points*	Outstanding (top 5%) *10 points*	
Summary Slide(s)	Present, reasonable, convincing, balanced *0 points*	1/4 *1 points*	2/4 *2 points*	3/4 *3 points*	4/4 *4 points*				

This is where a good project that spaced out a couple details makes up ground.

References

Cope, E.D., 1887, The dinosaurian genus *Coelurus*. American Naturalist, v. 21, p. 367-369

Cope, E.D., 1889, On a new genus of Triassic Dinosauria. American Naturalist, v. 23, p. 626.

Holtz, T.R. Jr., 2002, Chasing *Tyrannosaurus* and *Deinonynchus* around the tree of life: Classifying Dinosaurs. pp. 31-38 in Dinosaurs: The science behind the stories. AGU

Holtz, T.R. Jr. & Rey, L.V., 2008, Dinosaurs, the most complete up-to-date encyclopedia for dinosaur lovers of all ages. Random House, 428 pp.

Rinehart, L. F., Lucas, S. G., Heckert, A. B., Spielmann, J. A., and Celeskey, M. D. 2009, The paleobiology of *Coelophysis bauri* (Cope) from the Upper Triassic (Apachean) Whitaker quarry, New Mexico, with detailed analysis of a single quarry block: New Mexico Museum of Natural History and Science Bulletin, v. 45, 260 pp.

Tykoski, R. S., and Rowe, T., 2004, Ceratosauria, *in* Weishampel, D. B., Dodson, P., and Osmólska, H., eds., The Dinosauria: Second Edition: Berkeley, University of California Press, p. 47-70.

Grading nuts-and-bolts

APPALACHIAN GEOLOGY

Reference slide(s)	Present, complete, reasonable format, shows investment in project; scholarly sources. *0 points*	1/5 *1 points*	2/5 *2 points*	3/5 *3 points*	4/5 *4 points*	5/5 *5 points*	
Creativity	Apparent creativity *0 points*	Simply reused ABH slides *1 points*	Not really apparent *2 points*	Reasonably creative *3 points*	Particularly creative *4 points*		
Nomenclature	Proper use of italics and capitals *0 points*	T. Rex or similar gaffes; major issues. *1 points*	Distracting errors of italics/capitalization *2 points*	Decent grasp of taxonomic rules *3 points*	Great, no issues w/taxonomy *4 points*		

Final grade sheet

APPALACHIAN GEOLOGY

Grammar, proofreading, etc.	Reader's overall experience *0 points*	Challenging—major issues *1 points*	Significant errors present; distracting. *2 points*	Reasonable writing but with typos and/or other issues *3 points*	Clear writing, careful proofreading evident. *4 points*	The "Triassic" typo shoes up several times; distracting.
Instructions slides deleted	Didn't delete anything/reused template *0 points*	Extraneous slides present *1 points*	Only slides needed *2 points*			

Current grade in gradebook 92.05

Grading student 6 out of 74

Feedback comments

Paragraph

Only the second project I graded; seems pretty solid.

Above & Beyond

APPALACHIAN GEOLOGY

Mounts and Displays

Natural History Museum of Utah, Rio Tinto Center

Dinosaur Museum in Blanding, UT

Nagoya City Science Museum, from Gifu, Japan

Australian Museum by Robert Jones

The Wyoming Dinosaur Center

Prezi

Student Slide

From the horses' mouths

- **Needs Improvement:**
- Slightly more forgiving with grading, effort should matter.
- More project explanation.
- A little more explanation of what he wants from projects not just requirements
- More detail on assignments he wants completed maybe.

From the horses' mouths

APPALACHIAN GEOLOGY

- **Things done well:**
- Projects were very helpful and fun.
- Visuals used, as well as projects given were extremely helpful.
- Well organized and materials given/projects on ASU were very relevant and helpful.
- I enjoyed all of the creative projects and ability to study the dinosaurs we had interest in.
- I enjoyed the project greatly because I cannot express myself as well I would like to in a paper as I can in a creative project like this one

Conclusions—the toy assignment helps

APPALACHIAN GEOLOGY

- ...demonstrate proficiency in acquiring, interpreting, and disseminating dinosaur knowledge.
- ...incorporate scientific, especially geological perspective into the educational experience at ASU.
- Get 250-300 credit hours/offering w/o lab.
- Maintain standards w/out reading 80+ papers.
- Force a few more folks to face the "e" word, deep time, and other scientific concepts.
- Students appear to enjoy it

Pros & Cons

APPALACHIAN GEOLOGY

- **Pros:**
  - Scalable
  - Difficult to plagiarize (& archivable)
  - Could go into "e-portfolio"
  - Requires students to learn presentation software
  - Educates students about *Coelophysis*
- **Cons**
  - "Plug-and-chug"/Rubric hurts grade flexibility
  - Does not evaluate writing *per se*
  - References—what to do?
- **Future directions:**
  - Toy manufacture date vs. apparent "scientific age" (e.g, 1980s toy, 1960s knowledge)
  - Dissemination?

Acknowledgments

- Department of Geology, especially Dr. Bill Anderson for encouraging me to develop GLY 1842 Dinosaurs: Then & Now.
- The Adminisphere for putting GLY 1842 into a non-science theme.
- Many “A” students for providing project successes and sharing their work.
- Session organizers for including this whether or not it’s transformative.

Parasaurolophus in Left Lateral View

WEEEEEERRRRRKK!

***Parasaurolophus* in Dorsal View**

YES DINO! YAHHHSSS!

***Parasaurlophus* in Anterior View**